NOAA Involvement in the Albemarle/Pamlico Estuaries, North Carolina

July 1986

U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

NOAA Estuarine Programs Office

NOAA Involvement in the Albemarle/Pamlico Estuaries, North Carolina

July 1986

U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary

National Oceanic and Atmospheric Administration
Anthony J. Calio, Administrator

NOAA Estuarine Programs Office
Virginia K. Tippie, Director

NOAA INVOLVEMENT IN THE ALBEMARLE/PAMLICO ESTUARIES, NORTH CAROLINA

JUNE 1986

National Oceanic and Atmospheric Administration
Anthony J. Calio, Administrator

NOAA Estuarine Programs Office
Virginia K. Tippie, Director

In May, 1986, the Environmental Protection Agency and the State of North Carolina announced that a cooperative multi-year study would be conducted to characterize conditions in the Albemarle/Pamlico Sounds and to develop a management strategy to restore the system's water quality and living resources. To support the Albemarle/Pamlico program, NOAA is examining its ongoing activities to identify those which could support both our mandates and the goals of the program. The NOAA Estuarine Programs Office (EPO) prepared this document summarizing our ongoing involvement in the Albemarle/Pamlico system for 1985-86. We also designated individuals both on-site and in Washington, D.C. to coordinate NOAA's future activities in the Albemarle/Pamlico Sounds.

For more information, contact:

Dr. Ford Cross, Acting Director
Beaufort Laboratory, Southeast Fisheries Center
National Marine Fisheries Service, NOAA
Beaufort, North Carolina 28516
FTS 670-9724/9700
Commercial (919) 728-8724

and

Ms. Sharon K. Shutler
Southeast Estuarine Programs Coordinator
Estuarine Programs Office, NOAA
1825 Connecticut Avenue, N.W.
Washington, D.C. 20009
FTS and Commercial (202) 673-5243

TABLE OF CONTENTS Page

NOAA ACTIVITIES IN THE ALBEMARLE/PAMLICO SOUNDS

I. INTRODUCTION

The Albemarle/Pamlico Sounds comprise the third largest estuarine system in the United States. Located in eastern North Carolina, this estuarine complex supports major commercially and recreationally important fisheries and attracts tourists and residents to its picturesque marshes, beaches, and historic sites. This estuarine system, however, is subject to increasing development pressures. Large portions of watersheds are being cleared for agriculture, mining and urban development. These changes have led to major alterations of traditional drainage patterns resulting in nutrient enrichment, oxygen depletion, and physical habitat alterations and loss.

The high biological productivity, along with the recreational and tourism opportunities offered by the Albemarle/Pamlico estuaries, could be jeopardized by the high growth projected for the next two decades. While the system has not yet experienced the widespread environmental degradation pervasive in other estuaries, there are early warning signals. The challenge, therefore, is to maintain the biological integrity of the system; its fisheries productivity and aesthetic beauty.

The National Oceanic and Atmospheric Administration (NOAA) programs in the Albemarle/Pamlico Sounds are already providing information to address some of the problems. NOAA's programs are designed to characterize or describe the current status of the system, conduct research to fill information gaps, and provide this information to agencies responsible for managing natural resources or water quality. NOAA's oceanic programs in the Albemarle/Pamlico Sounds are administered primarily by the National Ocean Service, the National Marine Fisheries Service, and Oceans and Atmospheric Research (see tables 2 and 3).

II. ESTUARINE CHARACTERIZATION

Estuarine characterization is the essential first step in describing the health of an estuarine system. To characterize an estuary, existing information on the physical environment, water, and sediment quality, and associated plants and animals must first be identified and analyzed. This step reveals where additional data gathering efforts are necessary to complete the characterization. NOAA sponsors a number of efforts designed to characterize different aspects of the Albemarle/Pamlico Sounds system.

A. Data Archives and Data Assessments

National Estuarine Inventory (NEI). The NEI represents the cornerstone of NOAA's effort to develop a National capability to assess the health of the Nation's estuarine resources. The NEI describes the boundaries of 92 of the most important estuaries in the United States and includes information on the physical, hydrologic, and land use characteristics of each estuary. It also establishes a comprehensive framework for inclusion of additional data. Information developed for the inventory is contained in the National Estuarine Inventory Data Atlas, Volume I, Physical and Hydrologic Characteristics. The data base and atlas include information on the Albemarle/Pamlico Sounds and the adjacent Pamlico, Pungo, and Neuse Rivers. Volume II, Land Use Characteristics, will be published in 1986. Information from the National Coastal Pollutant Discharge Inventory, the National Coastal Wetlands Project, and the National Shellfish Register also will be incorporated into the NEI.

The National Coastal Pollutant Discharge Inventory (NCPDI). The NCPDI is a data base that contains estimates of all point and non-point sources of pollutant discharge into estuarine and coastal waters. Data collected extend landward to the head of estuaries and seaward to the boundary of the Exclusive Economic Zone. The NCPDI approximates pollutant discharges for a variety of contaminents including oxygen demanding materials, particulate matter, nutrients, heavy metals, petroleum hydrocarbons, chlorinated hydrocarbons, pathogens, sludge, and wastewater from 1980-1985. The NCPDI holds information on pollutant discharges for Albemarle/Pamlico Sounds.

The National Coastal Wetlands Data Base Project. This project summarizes by coastal county the distribution of four types of wetlands - swamps, tidal flats, salt marshes, and fresh marshes for 22 coastal States, including North Carolina, and is based on existing State and local wetland inventories. The inventory represents the status as of 1954 for North Carolina. A report published in January 1986 entitled "An Inventory of Coastal Wetlands of the USA" describes this project. A follow up project will use computer-assisted grid sampling of the maps produced for the National Wetlands Inventory by the U.S. Fish and

Wildlife to aggregate the wetlands types into the NEI.

The National Shellfish Register of Classified Estuarine Waters. The Register classifies 20.6 million estuarine acres of shellfish waters in terms of their ability to support shellfish safe for human consumption. NOAA produces this register in conjunction with the Food and Drug Administration. Acres are classified and mapped as conditionally approved, restricted, prohibited, or non-shellfish/non-productive for 22 coastal States. Classifications are available for shellfish growing waters in the State of North Carolina including Albemarle/Pamlico Sounds, Bogue Sound, the Pamlico, Pungo, and Neuse Rivers. In addition, NOAA has issued to the States a set of charts delineating the classified areas. The States are using both the register and the charts to develop reports on trends in classifications and to monitor the opening and closing of shellfish areas. The register thus provides an invaluable tool for determining the changes in the quality of estuarine shellfish waters and the potential impact on public health.

B. Stock Assessment and Fisheries Statistics

Legislative Grants Programs - Magnuson Act, Fisheries Development and Anadromous Fish. NOAA provides funds to the North Carolina Division of Marine Fisheries to conduct a cooperative regional fisheries statistics program. The State collects statistics on commercial fisheries by month, gear, and water body. These statistics are compiled in pounds and in value. NOAA also sponsors an adult fisheries assessment project in Pamlico Sound which entails sampling fish from long-haul seines and summer pound nets. The assessment targets weakfish, summer flounder, Atlantic croaker, spot, and bluefish. In two separate studies, Albemarle Sound river herring (alewife and blueback herring) and adult striped bass are sampled by the North Carolina Division of Marine Fisheries to determine size, age, sex, distribution, and relative abundance.

C. Environmental Description

The National Status and Trends Program (NS&T). NS&T was initiated in 1984 to describe the current levels and future trends of selected contaminants in water, sediments, fish, and shellfish at sites around the country. It is the only National program to collect consistent information on contaminent levels and fish disease throughout the Nation's coastal and estuarine environments using standardized quality assurance procedures. Products of the NS&T program will include research reports and a National data base that will aid in the prediction of trends in pollutant levels and their effects on living marine resources. The NS&T program has two major components: the Benthic Surveillance project and the Mussel Watch project. For the Benthic Surveillance project, sediments and bottomfish are sampled and analyzed for contaminants and disease at 50 sites around the country. One benthic surveillance site has been selected in the Albemarle/Pamlico Sounds (Jones Bay) with Atlantic croaker and spot as the target species. NOAA

is analyzing fish livers for trace elements, organic contaminants, and histological abnormalities and the sediments for trace elements, organic contaminants, total organic carbon, and grain size. The third year of sampling will begin this fall. For the Mussel Watch component, mussels (or other suitable bivalves) and sediments are analyzed for contaminant loads from 150 sites Nationwide. Bivalves also are examined for visible and histopathological diseases. Two mussel watch sites, one in the Albemarle Sound (Posquotank River mouth) and one in the Pamlico Sound (Wysoching Bay) have been selected.

III. ESTUARINE RESEARCH

The review and synthesis of data gathered in the characterization phase helps to identify areas where additional research is needed to support management decisions. NOAA's research activities in the Albemarle/Pamlico Sounds emphasize physical processes, ecosystem dynamics, and living marine resources and their habitats. Research is also directed toward identifying the effects of contaminants on estuarine organisms.

A. Physical Processes

NOAA funds universities, through its National Sea Grant College program, to examine the effects that freshwater drained from agricultural fields have on estuarine resources. Research is being conducted to develop methods to reduce this flow, and a computer model is being developed to predict how different agricultural practices and draining methods affect the volume of water funneled from the field. Supporting work is being undertaken to discern how salinity levels in the Albemarle/Pamlico Sounds respond to freshwater influxes. Research results will be used to develop a model to predict salinity changes resulting from variations in freshwater input.

B. Ecosystem and Nutrient Dynamics

Massive blooms of blue-green algae have occured in the lower Nuese River during some summers. NOAA is supporting Sea Grant scientists in efforts to determine how the river and blue-green algae respond to changes in nutrient levels. The results of this research will determine: 1) the quantities and seasonal cycles of new nitrogen entering the estuary, 2) the seasonal cycles of nitrogen assimilation and when and where nitrogen, light, and temperature limit nitrogen assimilation and productivity and, 3) relationships among nitrogen loadings, assimilation, and productivity.

In a related study, Sea Grant researchers will examine how the blue-green algae blooms affect the estuarine food chain. The scientists believe the algae may decrease the efficiency of the estuarine food chain and alter the species composition of fish living at bloom sites.

C. Living Resources

Life History. The menhaden commercial fishery is the largest in the United States by tonnage. NOAA research on menhaden includes determining the relationship between the numbers of menhaden immigrating and the survival of a given year class. In support of this study, NOAA is examining the geographical and temporal distribution of young-of-the-year Atlantic menhaden within estuaries, including Pamlico Sound. This project, in conjunction with efforts in adjacent sounds, should lead to the development of measures to estimate pre-recruit year-class size.

Sea Grant is funding scientists to examine the recruitment of hard clams and bay scallops. This project is designed to yield information on how extensively natural predators, (snapping shrimp and crabs) and habitat affect the production of clams and scallops. The research should identify recruitment requirements for 11 habitat types and will attempt to determine alternatives to prevent excessive predation from snapping shrimp and crabs. These scientists are also examining juvenile migration mechanisms. Dominant species of fish and shellfish in North Carolina are spawned offshore in the fall and winter and migrate as larvae or juveniles to estuarine nursery areas. Research conducted under this project will attempt to discover how larvae and juveniles ride wind-driven bottom currents across the Pamlico Sound after entering the inlets. Sea Grant, therefore, is: 1) determining the relative importance of Ocracoke and Oregon Inlets as sources of larval and juvenile spot, croaker, flounder, and menhaden to Pamlico Sound, 2) determining transport mechanisms, and 3) identifying the relation between juveniles which colonize nursery areas and seasonal production.

D. Estuarine Habitats

Fisheries-Habitat Interactions. Along the southeastern Atlantic and the Gulf of Mexico, data suggest that menhaden, particularly juveniles, feed on detritus. Wetland vegetation, marsh and seagrasses, are a major source of detritus and therefore important in the life cycle of menhaden. NOAA is studying the diet of these fish by sampling menhaden at 24 locations including the Pungo and South Creeks (both branches of the Pamlico River). The menhaden are analyzed to determine the taxonomic and biochemical characterizations of their stomach contents which will yield information on the role detritus plays in their diet.

High marshes, dominated by Juncus roemerianus, are frequently flooded for long periods of time providing both refuge and food for fish, crabs, and shrimp. The importance of these marshes as habitat, however, has never been adequately evaluated. NOAA, with the support of the U.S. Fish and Wildlife Service and in conjunction with East Carolina University, is studying the ecology of a Juncus roemerianus marsh on Cedar Island (Pamlico Sound) to determine which fish use this habitat. Food consumed by fish from this habitat are being evaluated as a measure of habitat use.

Habitat Alterations and Enhancement. In addition to contributing detritus and nutrients to estuarine waters, marshes dominated by Spartina alterniflora provide direct sources of nutrition and refuge to fish when flooded at high tide. Research by NOAA in the Newport River estuary and Bogue Sound is demonstrating that important fishes use the marsh surface in this manner. These initial findings have led NOAA and the U.S. Army Corps of Engineers to select an experimental site in Core Sound to evaluate the effectiveness of fisheries habitat enhancement measures as part of a Memorandum of Agreement (October 1985) between the agencies. The joint effort will entail transplanting a marsh and an eelgrass (Zostera marina) bed, evaluating its development and capacity to provide both habitat and food to fishery organisms.

NOAA also is studying how effectively mitigated marshes and seagrass meadows perform the functions of natural emergent and submergent wetlands. In one effort, NOAA is examining the utilization of mitigated Zostera marina by fish, shrimp, and crabs in Core Sound. Preliminary data indicate that fish use the mitigated areas less than natural areas and therefore support the hypothesis that long periods are required before mitigated habitats can evolve to meet the same fishery growth and survival requirements as natural habitat.

IV. ESTUARINE MANAGEMENT

NOAA's programs and activities encourage wise management of the Nation's estuarine resources. NOAA administers programs and grants which help manage the Nation's marine fisheries, protect valuable marine and estuarine habitats, and balance coastal development and conservation activities. NOAA also provides expertise to Federal and State agencies that have management responsibility in coastal areas.

A. Living Resources Management

Sea Grant researchers recently studied the effect of recreational fishing on the economy of the localities surrounding the Albemarle/Pamlico System. As a result of these studies, Sea Grant is completing an in-depth report that examines how various factors in the region affect the popularity of recreational fishing and how that popularity affects the region's economy.

B. Habitat Resources Management

NOAA participates in environmental decision making in cooperation with other Federal and State agencies involved in water resource planning and development in North Carolina. To prevent or reduce damage to fishery reources and their habitat, NOAA reviews dredge and fill proposals, and permits for waste discharge and construction in navigable waters. From January 1981 to December 1985, NOAA reviewed 1,171 permit applications to

the Corps of Engineers for projects in North Carolina, many of which were in the Albemarle/Pamlico Sounds area. Of these proposals, 547 requested permits to alter 3,119 acres of wetlands through dredging, filling, draining or impounding operations. To offset habitat losses from these projects, NOAA recommended mitigation for 576 acres through restoration or generation of new habitat.

C. Coastal Resources Management

Coastal Zone Management (CZM). In 1974, the State of North Carolina passed the Coastal Area Management Act (CAMA) to protect fragile resources by initiating planning and management at the State and local level. Building upon the CAMA, the State expanded this program to meet the requirements of the Federal Coastal Zone Management Act (CZMA) administered by NOAA. The North Carolina Coastal Management Program (NCCMP) was approved in 1978 by NOAA, and established a regulatory and planning program. The Natural Resources and Community Development (NRCD) was designated by the Governor to administer the program. Policy direction for both is provided by the Coastal Resources Commission (CRC), a 15-member group of citizens appointed by the Governor.

The coastal program requires local land use plans to be developed and adopted by local governments. The CRC establishes guidelines for the plans and approves them. The CRC also prepares plans should the local government fail to do so. Presently there are approved land use plans for all 20 coastal counties and 55 coastal municipalities. These plans are revised regularly to address new management concerns.

The regulatory program applies in areas designated as Areas of Environmental Concern (AECs). The designated AECs include coastal wetlands, estuarine shorelines and waters, public trust waters, ocean beaches, erosion and floodprone areas, small surface water supply watersheds, and public water supply well fields. These resources are the most sensitive in coastal North Carolina. Activities occurring in AECs require coastal development permits. Permits for "major development" are issued by the NRCD. About 200 major permits are processed each year. All other development activity is considered "minor development" and the corresponding permits are issued by local permitting officers who are designated by local governments and trained by the NCCMP.

Each year, the State is eligible for implementation grants under the CZMA. In FY86, most of these grant monies will be used to: 1) provide assistance to local governments for land use and water quality planning, 2) administer major development permits, 3) improve the public beach access program, and 4) acquire and preserve natural areas. Grant monies are also being used to undertake technical studies as necessary. For example, during FY85, technical studies monies were used to fund a study with North Carolina State University on water quality at marinas. The study assessed the concentration levels and transport of petroleum derivatives at several locations. Fecal coliform measures were also

taken.

Technical studies monies are also supporting the development of a water quality handbook which will provide a guide to local governments which will help them incorporate water quality considerations into land use plans. These considerations can then be applied to decisions on the siting of facilities and to agricultural practices.

In addition, the monies are supporting a wetlands mapping program through the NRCD Parks and Recreation Division. The mapping includes data both remotely sensed and ground truthed for all 20 coastal counties. The effort is closely linked to the Fish and Wildlife Service's National Wetlands Project.

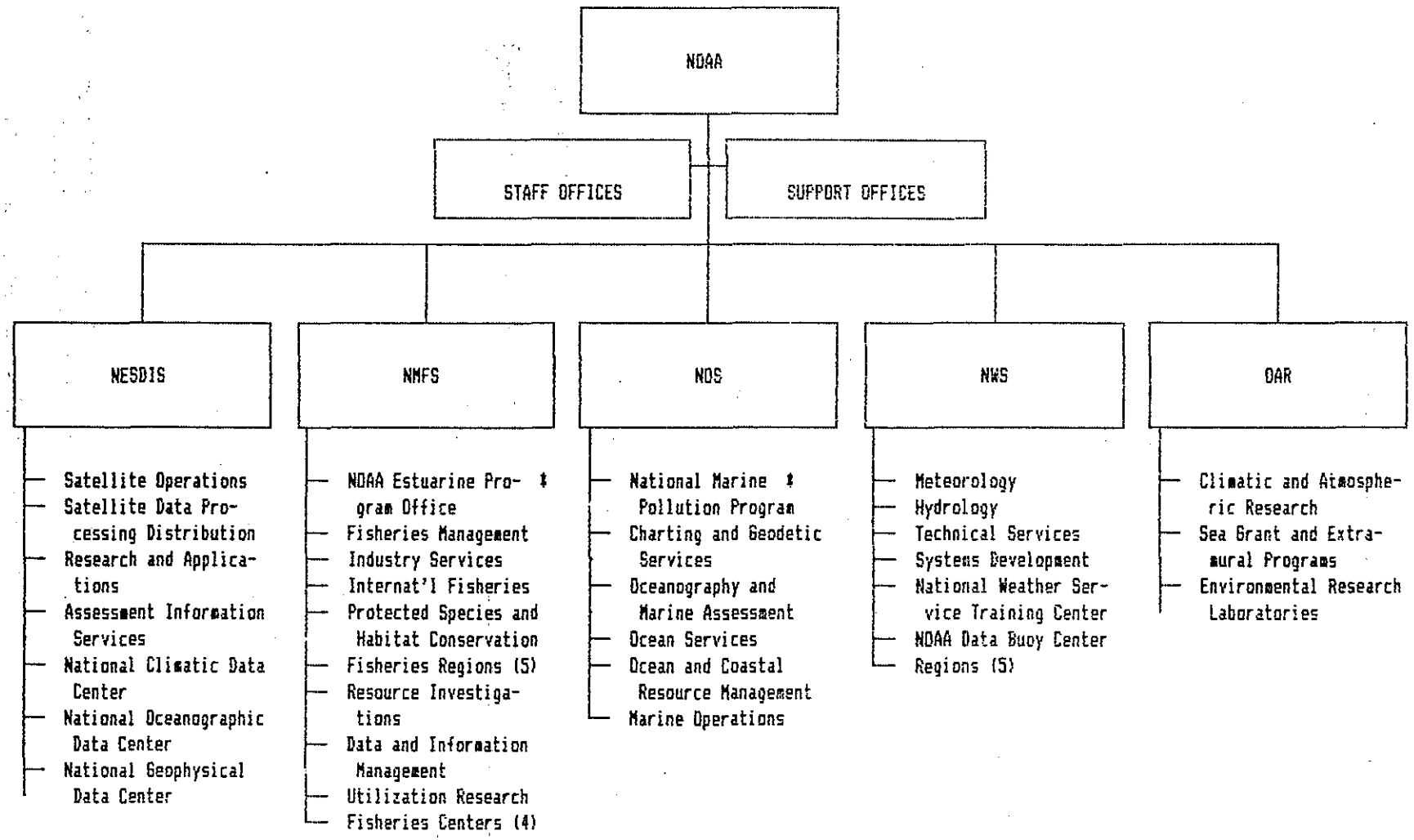
Estuarine Research Reserves. Under Section 315 of the CZMA, States are provided with 50 percent matching grants for acquiring, developing, or operating estuarine research reserves. The State of North Carolina has established a multiple site reserve according to the NOAA guidelines. Two components of this Reserve, the Rachel Carson and Currituck portions, border the Albemarle/Pamlico Sound complex. At Rachel Carson, habitat mapping is providing detailed information on the major habitat types within the research reserve, a description of the biological characteristics of the communities associated with each habitat, and a protocol for annual updating of the map.

In addition, a study on plant succession and stabilization of dredge spoils at Rachel Carson is also being conducted. The vegetation is sampled at different dredged material sites and is examined for species composition, frequency, and abundance. This study will reveal insight into the natural vegetative processes by which dredge spoil islands are colonized.

CONCLUSION

Recognizing the high biological productivity and economic importance of the Albemarle/Pamlico Sounds system, NOAA will continue its characterization, research, and management activities in these estuaries. Accordingly, NOAA will review its programs and identify those that will be particularly useful in addressing issues raised in the context of the National Estuarine Program. NOAA also will identify how its ongoing programs in data management, navigation, and weather forecasting can be used to better understand and manage the resources of the Albemarle/Pamlico Sounds.

Table 1. NOAA Organization



NOAA is composed of five line offices: the National Environmental Satellite Data and Information Service (NESDIS), the National Marine Fisheries Service (NMFS), the National Ocean Service (NOS), the National Weather Service (NWS), and the Office of Oceanic and Atmospheric Research (OAR).

* Agency-wide Offices

Table 2. Estimate of NOAA's Budget - Albemarle/Pamlico Sounds, 1985-1986

PROJECTS	BUDGET[1]
Estuarine Characterization	$372,500
Data Archives and Data Assessments	
National Estuarine Inventory[1]	
Stock Assessments and Fisheries Statistics	
Cooperative Fisheries Statistics[2]	
Adult Fisheries Assessment in Pamlico Sound[2]	
Albemarle Sound Alosids[2]	
Albemarle Sound Striped Bass[2]	
Environmental Description	
National Status and Trends Program	
Estuarine Research	$423,000
Physical Processes	
Ecosystem and Nutrient Dynamics	
Contributions of Nitrogen to the Neuse River	
Living Resources	
Menhaden Life History	
Recruitment of Hard Clams and Bay Scallops	
Trans-Pamlico Sound Migration of Juvenile Fishes	
Recreational Fishing Study	
Habitat	
Menhaden-Habitat Interactions	
Fishery Use of *Juncus* Habitat	
Mitigation of Transplanted Habitats	
Estuarine Management	$1,687,000
Coastal Resources Management	
Technical Quality Assistance for Land Use and Water Planning[3]	
Administration of Permits[3]	
Permit Monitoring and Enforcement[3]	
Technical Studies[3]	
Beach Aquisition[3]	
Local Land Use Plan Updates[3]	
Natural Area Aquisition[3]	
Submerged Land Claims Resolution[3]	
Estuarine Research Reserves	
Habitat at Mapping of Rachel Carson	
Aerial Mapping of 4 sites	
Plant Succession and Stabilization	

1. Budget figures are estimates. Certain activities are conducted nationally and are not included; operational activities are not included.

2. Fishery grants; NOAA to the North Carolina Division of Marine Fisheries.

3. Coastal Zone Management Interstate Grants; NOAA to the North Carolina Coastal Management Program. These grants cover acivities state-wide.

Table 3. NOAA Involvement in Albemarle/Pamlico Sounds, 1985-1986, Breakdown by Line Office

Organization	Projects	Budget[1]
National Marine Fisheries Service		$471,000
° Fisheries Management	° Adult Fisheries Assessments ° Albemarle Sound Alosids ° Albemarle Sound Striped Bass	
° Southeast Regional Office	° Cooperative Fishery Statistics	
° Southeast Fisheries Center (Beaufort)	° Menhaden Life History ° Menhaden-Habitat Interactions ° Fishery Use of Juncus Habitat ° Mitigation of Transplanted Habitats	
National Ocean Service		$1,773,000
° Ocean Assessments Division	° National Estuarine Inventory ° National Status & Trends	
° Oceans and Coastal Resource Mangement	° Land Use and Water Quality Planning[2] ° Permits Administration[2] ° Permit Monitoring[2] ° Technical Studies[2] ° Beach Aquisition[2] ° Submerged Land Claims[2] ° Habitat Mapping-Rachel Carson ° Aerial Mapping ° Plant Succession & Stabilization	
Oceanic & Atmosheric Research		$238,000
° Sea Grant	° Recreational Fishing Study ° Recruitment of Clams and Scollops ° Trans-Pamlico Sound Migration ° Physical Processes ° Contributions of Nitrogen in the Nuese River	

1. Budgets are estimated.

2. State-wide grants.